

## **Tracking the Course of Mathematics Problems**

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### **Summary of Merit Review and Recommendation**

***Note to Reader:*** *This statement has been prepared by staff of the National Science Foundation in order to provide an illustration of the proposal review process and the award recommendation. While it draws on actual points made by the proposal reviewers, review panelists, and program officer, it is a synopsis and synthesis of the actual reviews and award decision. We recognize that all proposals and reviews have strengths and weaknesses. We therefore offer this only as an example of a “typical” set of points made for a funded proposal, and we hope this serves to illuminate the process and to provide helpful guidance to prospective investigators.*

This proposal investigates how students solve mathematical problems by integrating tools of cognitive psychology, neuroimaging, and educational technology. The investigators build on their previous work on computerized intelligent algebra tutor by incorporating information from students' eye movements, an indicator that can be revealing of the students' cognitive states. Parallel neuroimaging studies seek to track the roles of the brain systems over the course of mathematical skills acquisition using a design that attempts to isolate component algebraic operations at varying levels of difficulty.

Without exception, the panelists found this to be a strong proposal, where the research design, methodological integration, and unifying questions could serve as a model for the ROLE program. A couple of reviewers expressed doubts concerning the motivating theoretical approach of the study (the ACT-R theory), although they still found much to like in the proposal.

Significant opportunities were seen for the refinement of the algebra tutor, and for further integration of that body of work with cognitively and neurally based research on eye movements. The panel had mixed reactions to the proposed neuroimaging work. The intent to build a bridge to analysis at the brain level was endorsed by all but some reviewers thought that these studies and their justification needed to be more clearly developed. [Note: The program officer discussed this with the investigators who agreed to take additional steps to deepen the connections between this project and other brain based and cognitive work. They agreed to involve additional experts in related fields and to organize a conference on mathematical learning and the brain.] The program officer concurred with the panel recommendations.

